

STELLAR ORIGINS OF ^{13}C - AND ^{15}N -ENRICHED PRESOLAR SiC GRAINS

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Extreme excesses of ^{13}C ($^{12}\text{C}/^{13}\text{C} < 10$) and ^{15}N ($^{14}\text{N}/^{15}\text{N} < 20$) in rare presolar SiC grains have been considered diagnostic of an origin in classical novae [1], though an origin in core-collapse supernovae (CCSNe) has also been proposed [2]. We report multi-element isotopic data for 19 ^{13}C - and ^{15}N -enriched presolar SiC grains ($^{12}\text{C}/^{13}\text{C} < 16$ and $^{14}\text{N}/^{15}\text{N} < \sim 150$) from an acid-resistant residue of the Murchison meteorite. These grains are enriched in ^{13}C and ^{15}N , but with quite diverse Si isotopic signatures. Four grains with $^{29,30}\text{Si}$ excesses similar to those of type C SiC grains likely came from CCSNe that experienced explosive H burning occurred during their explosions [3]. The independent coexistence of proton- and neutron-capture isotopic signatures in these grains strongly supports heterogeneous H ingestion into the He shell in at least some pre-supernova massive stars. Also, we found that seven ^{15}N -enriched AB grains ($\sim 25 < ^{14}\text{N}/^{15}\text{N} < \sim 150$) have distinctive isotopic signatures compared to eight putative nova grains with ^{30}Si excesses and ^{29}Si depletions, such as higher $^{14}\text{N}/^{15}\text{N}$, lower $^{26}\text{Al}/^{27}\text{Al}$, and lack of ^{30}Si excess, indicating weaker proton-capture nucleosynthetic environments. Interestingly, two of the eight putative nova grains and four of the seven ^{15}N -enriched AB grains show lower-than-solar $^{34}\text{S}/^{32}\text{S}$ ratios that cannot be explained by classical nova nucleosynthetic models. We discuss these signatures within the CCSN scenario.

[1] S. Amari *et al.*, ApJ **551**, 1065 (2001).

[2] L. R. Nittler & P. Hoppe, ApJ **631**, L89 (2005).

[3] M. Pignatari *et al.*, ApJ **808**, L43 (2015).